

## GOLF CLUB AND MANUFACTURING METHOD THEREOF

## BACKGROUND OF THE INVENTION

## 5 Field of the invention

The present invention relates to a golf club and a manufacturing method thereof

## Description of the Related Art

10 In FIG.1 of Japanese Un-Examined patent publication number 11-19254, for example, is disclosed a conventional golf club, called a metal wood, where a shaft is fitted to a head made by combining metal pieces such as a face shell, a sole and peripheral surface shell and a crown shell. One of known methods for manufacturing a head of such a golf club is such that respective parts of the head that are stamped out from thin sheets of plate materials are formed into a predetermined shape by pressing and bending, and  
15 then they are combined together by welding. In that case, respective parts are formed to a substantially uniform thickness due to the manufacturing by pressing. For example, in the case that a head is divided into a face shell, a sole and peripheral surface shell and a crown shell as above mentioned so that respective parts may be manufactured separately, the thickness of the respective parts would become substantially the same eventually, and thus there would naturally exist a limit to size in allowing the head to weigh as much as you desire. Whilst such conventional method also enables one to  
20 manufacture a large-sized head with a 300 cc class large volume, by employing titanium alloy as a material, there is the possibility that the weight limitation set to the head makes it impossible to provide a separate balance weight to adjust the position of the center of gravity of the head.  
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A solution for solving such problems is to make the face, the peripheral portion thereof and the sole thick enough to withstand an impact at the time of striking a ball, while making the remaining portions thinner than conventional ones. More specifically, a first solution is to join thin plate materials where a thin thickness is desired, while a  
30 second solution is to subject a whole or at least a part of respective outside and/or inside surfaces of the sheet materials to chemical grinding to thereby adjust the weight and thickness of materials used for a hollow club head, as disclosed in paragraph number

0008 of Japanese Un-Examined patent publication number 8-155062.

Such conventional methods, however, have the following drawbacks. First, according to the first solution in which thinner plate materials are partially joined where they are desired, not only the increased number of parts and costs are resulted, but the parts are deformed due to the heat when welding and joining. The thinner the plate materials are, the more they become susceptible to such thermal deformation, thus leading to the resultant inconstant configuration of the head. On the other hand, according to the second solution in which chemical grinding is used, particularly when titanium undergoes pickling, titanium absorbs hydrogen so that it becomes brittle. Particularly, beta type titanium alloy which is now commonly used for the material of heads has a greater tendency to become brittle.

In the meantime, a blast method is a processing method where abrasive (blast material) is blasted to a surface of a material, using compressed air and centrifugal force. As prior art publications which disclose such blast method for forming a head are known, for example, Japanese Un-Examined patent publication number 61-232875 disclosing the use of sand blast marking method for a golf club head, Japanese Registered patent publication number 2865127 disclosing a manufacturing method of a golf club head and Japanese Un-Examined patent publication number 9-182818 disclosing a golf club and manufacturing method thereof. The above-mentioned first prior art publication discloses the forming of a marking on a head by blasting abrasive grains with a masking layer being in close contact with a head surface to be marked (see lines 2 to 6, lower left column, page 2). The second prior art publication discloses a method of manufacturing a golf club head with at least a face and a sole thereof being formed from a magnesium group alloy, where the surface of the magnesium group alloy is washed by blast (see paragraph number 0005). Further, the third prior art publication discloses the forming of fine irregularities at least on a face of a head by a sand blast process or the like (see paragraph number 0005).

Whilst these conventional methods for manufacturing a golf club head exploiting such blast methods disclose to form markings, fine irregularities and to carry out washing, there has ever been no technical idea to adjust the thickness of respective shells.

## SUMMARY OF INVENTION

To eliminate the above problems, it is, therefore, an object of the present invention to provide a golf club in which the position of the center of gravity can be easily adjusted, by freely controlling the thickness of head shells, enabling the large-sizing of a golf club head.

It is another object of the present invention to provide a method for manufacturing such a golf club.

To attain the above objects, there is provided, according to a first aspect of the present invention, a golf club comprising a head formed by combining a plurality of metal shells and a shaft attached to the head, wherein at least a part of said metal shells is formed into a certain thickness by a blast grinding process.

According to the structure of the first aspect, it is possible to adjust the thickness by a blast grinding process.

According to a second aspect of the present invention, there is provided a golf club according to the first aspect, wherein at least a partial portion of said metal shell is formed into a different thickness than that of the remainder thereof by subjecting at least a part of a certain surface thereof to the blast grinding process.

According to the structure of the second aspect, it is possible to adjust the thickness of the shell on a certain surface by grinding at least a part of the same face.

According to a third aspect of the present invention, there is provided a method for manufacturing a golf club, comprising a head formed by combining a plurality of metal shells and a shaft attached to the head, which comprises the step of adjusting a thickness of at least a part of said metal shells by a blast grinding process.

According to the method of the third aspect, any desired position on the shells can be formed to a desired thickness by a blast grinding process.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will become apparent to those skilled in the art, from the following description of the preferred embodiments of the invention, wherein reference is made to the accompanying drawings, in which:

FIG.1 is a partially cutaway perspective view illustrating an embodiment of the present invention.

FIG.2 is a perspective view illustrating an embodiment of the present invention.

5 FIG.3 is a partially cutaway front view illustrating an embodiment of the present invention.

FIG.4 is an exploded perspective view illustrating an embodiment of the present invention.

10 FIG.5 is a rear view showing a face shell of a golf club according to an embodiment of the present invention.

FIG.6 is a bottom view showing a sole shell and a peripheral side shell of a golf club according to an embodiment of the present invention.

FIG.7 is a plan view showing a crown shell of a golf club according to an embodiment of the present invention.

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#### DESCRIPTION OF THE PREFERED EMBODIMENTS

Hereunder is a description of an embodiment of the present invention with reference to the appended drawings. A golf club head 1 (hereunder referred to as a head) made of titanium alloy comprises a face portion 2 serving as a surface for striking, a crown 3 on an upper side, a sole portion 4 and a peripheral side surface portion 5. A shaft 7 provided with a grip (not shown) on an upper end is connected to a hosel 6. The head 1 is constructed by joining respective edges of a plurality of metallic shells together by welding, which are three metallic shells in the present embodiment, consisting of a face shell 11 corresponding to the face portion 2, a crown shell 12 corresponding to the crown 3, a sole shell 13 corresponding to the sole 4 and a peripheral side shell 14 corresponding to the peripheral side surface portion 5, said sole shell 13 and the peripheral side shell 14 being formed integrally. The face shell 11, crown shell 12, sole shell 13 and peripheral side shell 14 are obtained by stamping metal pieces out of thin sheets of titanium alloy or the like, and then bending them by pressing, so that they are assembled into the head 1 by welding the respective edges thereof to one another. Alternatively, the respective shells 11, 12, 13, 14 may be manufactured by hot forging or casting.

Further, one half-hosel shell 15 forming one half of the hosel 6 is provided so as to integrally extend from one side of the crown shell 12. The other half-hosel shell 16 forming the other half of the hosel 6 is integrated with said peripheral side shell 14. Thus, the edges of these half-hosel shells 15, 16 are joined together integrally with said face shell 11. A shaft attachment pipe 17 for attaching the shaft 7 is fitted into the hosel 6 formed by said half-hosel shells 15 and 16.

The thickness of the respective shells 11, 12, 13 and 14 is adjusted by a blasting method through which the surface of a material is subjected to grinding by blasting abrasive (blasting material) thereto, using compressed air and centrifugal force or the like. Namely, the grinding process by blasting method of the invention is such that an abrasive S, comprising metals such as iron, sand carbides and oxides, more specifically GC #80 of Green Carborundum or the like is blasted against the surface of work pieces (i.e., the shells 11, 12, 13, 14) put on a turn table T in advance, at high speed and an injection pressure of 0.5 MPa, for example, thereby grinding the surface. The surfaces thus ground are the inside and/or outside surfaces of the respective shells 11, 12, 13 and 14. Through the foregoing grinding process, the face shell 11 may be formed thicker in its center portion in such a manner that the thickness "A" of the center portion of the face shell 11 is formed as thick as 2.6mm, while the thickness "a" of the ground peripheral portion surrounded by chain line in the drawing as thin as 1.8 mm. The crown shell 12 may be formed thicker in its peripheral portion such that the thickness "B" of the peripheral portion is formed as thick as 1.0 mm, while the thickness "b" of the ground center portion thereof which is surrounded by one-dotted chain line in the drawing is formed as thin as 0.8 mm. Further, the integrated sole shell 13 and peripheral side shell 14 may be formed such that the thickness C of the sole shell 13 may be formed as thick as 1.15 mm, while the thickness "c" of the ground peripheral side shell 14 surrounded by one-dotted chain line in the drawing is as thin as 0.8mm so that the thickness of the sole shell 13 may be formed thicker.

After the thickness of the respective shells 11, 12, 13, 14 is adjusted thus way, they are allowed to undergo a pressing process to be formed into a predetermined shape, where necessary, and then the respective edges are welded while the hosel 6 is formed by mating the aforesaid half shells 15 and 16 each other, so that the attachment pipe 17 is inserted into the hosel 6 to thereby insert the shaft 7 into the attachment pipe 17.

According to the foregoing embodiment, there is provided a golf club comprising the head 1 formed by combining a plurality of shells 11, 12, 13 and 14, and the shaft 7 attached thereto, wherein the respective shells 11 to 14 are formed with thinned portions having smaller thickness a, b, c and d by grinding, using blasting shot S, the respective shells 11, 12, 14 can be lightened by about 5g, while the weight thus saved can be freely distributed so that it becomes easier to adjust the position of the center of gravity, enabling the provision of a further large-sized head. Further, As compared to the chemical process, the grinding method is more advantageous in uniformity of shape, costs and long-lasting strength. Furthermore, by adjusting the thickness of the respective shells 11, 12 and 14, in other words, by adjusting the thickness "a", "b", "c" of the head 1, not only the position of the center of gravity but also the moment of inertia of the head can be adjusted, depending on which portion of the head are ground.

Additionally, like in said face shell 11 where the peripheral portion thereof is ground so as to make the thickness "a" of the peripheral portion smaller than the thickness "A" of the center portion thereof, at least a part of a certain surface of the head is formed with a thickened portion relative to the remaining portion of the same surface, by blast grinding, so that the adjustment of the thickness can be carried out on the same surface such as on the face portion 2 of the head 1, whereby not only the precise weight distribution and reduction of weight can be carried out, but also the degree of freedom in design can be improved by changing the thickness of a part of the face portion 2.

Also, in the method for manufacturing a golf club comprising the head 1 formed by combining a plurality of metal shells 11, 12, 13, 14, and the shaft 7 attached thereto, the thickness of at least a part of said respective shells is adjusted by grinding, using a shot blasting S, whereby the thickness of the material can be uniformly reduced even if the material is a titanium alloy or the like. Moreover, as the blast grinding process allows abrasive S to be blasted against any desired position, any desired portion in the respective shells 11, 12, 13 and 14 can be readily formed to any desired thickness. Additionally, as compared to the chemical process or simple assembly of thin sheets, the shape of the head is made more stable, with the resultant better cost performance and strength.

In addition to the foregoing, as the respective shells are placed on the turn table T for the grinding process, it is possible to automate the operation so that the process can

be performed in succession.

In the meantime, the present invention should not be limited to the above embodiment, but various modifications are possible within the scope of the invention. Although a hollow metal head is described in the embodiment, the invention is applicable to both an iron head and a putter head. Also, whilst the three of the face shell 11, crown shell 12, sole shell 13 and peripheral side shell 14 are subjected to the grinding process in the foregoing embodiment, at least one of the four shells may be ground. Further, whilst the parts are subjected to the grinding process in the foregoing embodiment, raw material, materials partially joined by welding or the like and even finished products may undergo the blast grinding of the invention. Alternatively, a relatively thick metal sheet may be ground except a part thereof so as to make it serve as a balance weight. As such a balance weight is a built-in weight, there is no likelihood that it drops out.